

POWER ASSISTED DRILL PRESS

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This application claims priority of U.S. Provisional Patent Application #60/412,701, filed 9/23/2002.

BACKGROUND OF THE INVENTION

8 The present invention relates in general to drill press devices, and more particularly, to a novel
9 drill press apparatus having a controlled power assisting feed mechanism and a vacuum holding
10 system.

11 In a conventional drill press, a rack and pinion gear is typically used to linearly move the
12 rotating drill chuck toward the work material. The rack and pinion system applies the force to the
13 drill bit through said chuck. Said drill bit utilizes said force to bore through the work material.
14 Unfortunately, a conventional drill press is often heavy, not portable, and unable to drill a hole onto
15 a surface unless the work material is between the drill and drill press table or base. Even the
16 commercially available drill press stands which utilize conventional hand held drill motors, exhibit the
17 aforesaid undesirable features. Moreover, those commercially available drill presses which are
18 reasonably portable rely upon a magnetic base or clamps for attachment, mounting, and holding. This
19 unfortunately limits use to magnetically attachable materials such as steel or iron or tends to mark or
20 deform the mounting surface respectfully.

21 The present art overcomes the prior art limitations by providing a drill motor and chuck
22 combination which is mounted with a motor frame and linearly actuated via the force of a feed
23 cylinder. Preferably, the feed cylinder is a pneumatically actuated cylinder but may also be hydraulic,
24 electromagnetic, or a mechanical force actuator in alternative embodiments. Also, the drill motor is
25 preferably a commercially available pneumatically operated hand held drill with attached chuck but
26 may also be electrically or hydraulically actuated, whether commercially available or custom built for
27 the present art. The linearly moveable motor frame is movably mounted onto or with a press frame.
28 The present art further provides for quick and easy securing and removal of the press onto a surface
29 via the action of a suction cup. The suction cup attachment method allows for non-deforming
30 attachment and mounting to surfaces which are either magnetic or non-magnetic.

31 An alternative embodiment of the present invention places the feed cylinder at a base plate

1 instead of a top plate. This alternative embodiment allows the feed cylinder to apply force to and
2 move the work material toward the drill bit instead of the drill bit moving toward the work material.
3 This alternative embodiment preferably secures the drill motor to the top plate of said press frame
4 which also functions as a motor frame. Further alternative embodiments may utilize both a feed
5 cylinder on the top plate and a feed cylinder on the base plate. In this configuration, typically the
6 shaft of the air cylinder mounted on the base plate contains a shaft tip having a recess for drill bit
7 clearance when the bit bores through the work material. Alternative embodiments may forego use
8 of the shaft tip without departing from the scope of the present art.

9 The preferred embodiment of the present invention provides a lightweight and portable power
10 assisted drill press apparatus which only requires compressed air for operation. A further
11 embodiment of the present invention provides a unique suction cup base which allows for mounting
12 on any surface capable of holding the vacuum of said suction cup. This alternative mounting method
13 allows for power assisted drilling on surfaces which otherwise would require drilling by hand.

14 Accordingly, it is an object of the present invention to provide an improved power assisted
15 drill press which in a preferred embodiment is capable of full operation from a pneumatic supply.

16 Another object of the present invention is to provide an improved power assisted drill press
17 which is portable and capable of controllably feeding the drill or work material via a user's actuation.

18 A further object of the present invention is to provide an improved power assisted drill press
19 having a suction cup base which is capable of attaching to any surface which can maintain the suction
20 cup vacuum, even if the surface is not planar or flat.

21 A still further object of the present invention is to provide an improved power assisted drill
22 press which allows a person to operate the apparatus with a single hand when required.

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SUMMARY OF THE INVENTION

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26 To accomplish the foregoing and other objects of this invention there is provided an improved
27 power assisted drill press apparatus for use in applications where a drill press is desired or required.
28 In a preferred embodiment, the apparatus comprises a drill motor and chuck combination which is
29 mounted with a motor frame and linearly actuated via the force of a feed cylinder. Alternative

1 embodiments utilize a suction cup which provides for quick and easy securing and removal of the
2 press onto a surface via the suction action of said cup. Further alternative embodiments place the
3 feed cylinder at a base of the apparatus, thereby applying force to the work material and moving said
4 material toward the drill bit instead of the drill bit moving toward the work material.

5 Preferably, the feed cylinder is a pneumatically actuated cylinder but may also be hydraulic,
6 electromagnetic, or a mechanical force actuator. Also, the drill motor is preferably a commercially
7 available pneumatically operated hand held drill with attached chuck but may also be electrically or
8 hydraulically actuated, whether commercially available or custom built for the present art. The
9 linearly moveable motor frame is movably mounted onto or with a press frame.

10 In a preferred embodiment, the motor frame first comprises a motor plate having a hole
11 through which said drill motor is placed and held, preferably with a set screw. In a preferred
12 embodiment, the drill motor chuck and drill bit extends through the motor plate. Attached with said
13 motor plate is the first end(s) of one or more guide rods. Said guide rods preferably attach opposite
14 of said drill motor chuck and drill bit extension. A second end(s) of said guide rod(s) aligns with and
15 moveably mates through one or more guide holes in a top plate of the press frame. The top plate of
16 said press frame is mounted onto, near, or toward a first end of a frame support or shaft which
17 extends and mounts with a frame base.

18 In the preferred embodiment, one or more springs are placed onto said guide rods between
19 said second end(s) and said top plate of the press frame. Near said second end(s) is preferably placed
20 one or more keepers to maintain said springs in position and compression on said rods, between said
21 top plate and said keepers. Said springs serve to supply retraction force to the motor frame when the
22 feed cylinder is not actuated.

23 Also mounted onto said top plate of said press frame is the feed cylinder. Preferably said feed
24 cylinder mounts between said second ends of said guide rods. In the preferred embodiment, the feed
25 cylinder supplies a force onto said drill motor or motor frame and thereby causes the combination,
26 including the guide rods, to move toward the work material. In the preferred embodiment, the feed
27 cylinder is pneumatically controlled with an air pressure regulator. That is, the air pressure regulator
28 controls and regulates the air pressure in the cylinder via the user's desired input, thereby controlling
29 the force which is placed onto the work material through the drill bit.

1 Preferably, the air pressure regulator is mounted with or near said motor frame whereby the
2 hand of the user stays near and follows the drill motor actuation switch and pressure regulator as the
3 drill bit approaches the work material. A unique feature claimed in an embodiment of the present
4 invention and in furtherance of the foregoing is the ability of the user to utilize the index finger to
5 control the speed of the drill motor and the thumb of the same hand to control the force on and
6 movement of the drill bit.

7 One of the embodiments of the present invention utilizes a suction cup mounted with a second
8 end of said frame support. The suction cup allows the drill press to be mounted onto and drill into
9 a surface. This feature is especially useful when the work material cannot fit between the drill bit and
10 base plate. The feature, unlike magnetic base drill presses, allows attachment to a surface even if the
11 surface has a low magnetic permeability such as aluminum, low iron content metals, and non metals
12 such as plastics and woods. Said suction cup is preferably evacuated and held in place via the vacuum
13 of a venturi attached with said suction cup. In the preferred embodiment, a pneumatic switch or valve
14 is located on or near the motor frame or motor plate and allows the user to easily supply compressed
15 air to the venturi which supplies vacuum to the suction cup.

16 An alternative embodiment of the present invention places the feed cylinder at the base plate
17 instead of the top plate. This alternative embodiment allows the feed cylinder to apply force to and
18 move the work material toward the drill bit instead of the drill bit moving toward the work material.
19 This alternative embodiment preferably secures the drill motor to the top plate of said press frame
20 which also functions as the motor frame.

21 For all of the aforesaid pneumatic devices, i.e. motor, switch, regulator, venturi, or other
22 device, a pneumatic source is presumed available and able to feed each of the aforesaid components.
23 The aforesaid press and motor frames and associated components may be manufactured from a
24 variety of materials including but not limited to metals and alloys thereof, plastics, and composites.
25 In a preferred embodiment, the frame and associated components are manufactured from an
26 aluminum alloy and the guide rods and frame support are manufactured from steel.

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BRIEF DESCRIPTION OF THE DRAWINGS

29 Numerous other objects, features and advantages of the invention should now become

1 apparent upon a reading of the following detailed description taken in conjunction with the
2 accompanying drawings, in which:

3 FIG. 1 shows a perspective view of the power assisted drill press without the air feed lines
4 and the suction cup.

5 FIG. 2 shows a left side plan view of the power assisted drill press with the air feed lines and
6 the suction cup. The base plate is rotated into a position substantially near or in the same axis as the
7 drill bit.

8 FIG. 3 shows a perspective view of the power assisted drill press with the suction cup and
9 base plate support and without the air feed lines. The base plate is rotated to serve as a stabilizing
10 moment arm relative to the drill bit force when the suction cup is utilized.

11 FIG. 4 shows a perspective view of the power assisted drill press with the suction cup and
12 base plate support and without the air feed lines. The base plate is rotated into a position substantially
13 near or in the same axis as the drill bit.

14 FIG. 5 shows a side plan view of an alternative embodiment of the power assisted drill press
15 with the air feed lines. This alternative embodiment has the air feed cylinder located with the base
16 plate.

17 FIG. 6 shows a pneumatic schematic diagram of the air supply to the drill motor and valve,
18 feed cylinder and regulator, and suction cup, venturi, and valve.

19 FIG. 7 shows a bottom plan view of the suction cup and mating plate of the present invention.

20 FIG. 8 shows a cross sectional view of the suction cup and mating plate of the present
21 invention taken along line 7-7 in Figure 7.

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DETAILED DESCRIPTION

24 Referring now to the drawings, the improved power assisted drill press apparatus **10** is shown
25 in its preferred and alternative embodiments. The apparatus **10** is especially useful in applications
26 where a portable and self feeding drill press is desired or required and when said drill press requires
27 non-destructive mounting on a non-magnetic surface.

28 The present art overcomes the prior art limitations by providing a drill motor **18** and chuck
29 **22** combination which is mounted with a motor frame **12** and linearly actuated via the force of a feed

1 cylinder **40**. Preferably, the feed cylinder **40** is a pneumatically actuated cylinder but may also be
2 hydraulic, electromagnetic, or a mechanical force actuator. Also, the drill motor **18** is preferably a
3 commercially available pneumatically operated hand held drill with attached chuck **22** but may also
4 be electrically or hydraulically actuated, whether commercially available or custom built for the
5 present art. The linearly moveable motor frame **12** is movably mounted onto or with a press frame
6 **51**. The present art further provides for quick and easy securing and removal of the press **10** onto
7 a surface via the action of a suction cup **68**. A drill bit or equivalent element, including but not
8 limited to countersink bits, reamer bits, taps, or deburring tool bits, are typically mounted within said
9 chuck **22** to perform the desired drilling operation, but alternative embodiments may forgo use of the
10 chuck **22** and utilize other means to attach the drill bit or equivalent element to the drill motor **18**.
11 In the preferred embodiment, said bit is opposite yet substantially pointing toward a plane of a second
12 end **61** of a frame support **58** of said press frame **51**.

13 In a preferred embodiment, the motor frame **12** first comprises a motor plate **14** having a hole
14 **16** through which said drill motor **18** is placed and held, preferably with a set screw **24**. In a preferred
15 embodiment, the drill motor **18**, chuck **22**, and drill bit extends through the motor plate **14**. Attached
16 with said motor plate **14** is the first end(s) **28** of one or more guide rods **26**. In the preferred
17 embodiment, two guide rods **26** are utilized. Said guide rods **26** preferably attach opposite of said
18 drill motor **18**, chuck **22** and drill bit extension. Alternative embodiments may place or locate said
19 guide rods **26** at various locations on or with said motor plate **14** without departing from the scope
20 and spirit of the present invention. A second end(s) **30** of said guide rod(s) **26** aligns with and
21 moveably mates through one or more guide holes **38** in a top plate **36** of the press frame **51**.
22 Alternative embodiments may attach the drill motor **18** and chuck **22** combination in a plurality of
23 ways including but not limited to clamps, welds, or bolts.

24 In the preferred embodiment, one or more springs **34** are placed onto said guide rods **26**
25 between said second end(s) **30** and said top plate **36** of the press frame **51**. Near said second end(s)
26 **30** is preferably placed one or more keepers **32** to maintain or contain said springs **34** in position and
27 compression on said rods **26**, between said top plate **36** and said keepers **32**. Said springs **34** serve
28 to supply retraction force to the motor frame **12** when the feed cylinder **40** is not actuated.
29 Alternative embodiments may utilize springs in tension between said top plate **36** and said motor plate

1 **14**, supply retraction force with an air cylinder, or forego use of said springs **34** completely.

2 Also mounted onto said top plate **36** of said press frame **51** is the feed cylinder **40**. Said top
3 plate **36** having a through hole **48** for the moving shaft **44** of said cylinder **40** to contact and linearly
4 move the drill motor **18** or motor frame **12**. Preferably said feed cylinder **40** mounts between said
5 second ends **30** of said guide rods **26**. The feed cylinder **40** also is preferably mounted with threads
6 into said through hole **48** of said top plate **36**. Alternative embodiments may utilize any location or
7 method of attachment of said feed cylinder **40** onto said top plate **36** without departing from the
8 scope and spirit of the present invention.

9 In the preferred embodiment, the feed cylinder **40** supplies a force onto said drill motor **18**
10 or motor frame **12** and thereby causes the combination, including the guide rods **26**, to move toward
11 the work material. In the preferred embodiment, the feed cylinder **40** is pneumatically controlled with
12 a pneumatic or air pressure regulator **64**. That is, the air pressure regulator **64** controls and regulates
13 the value of the air pressure in the cylinder **40** via the user's desired input, thereby controlling the
14 force which is placed onto the work material through the drill bit. That is, the air pressure regulator
15 **64** has an activating lever **67** or switch which may be pushed to control the pneumatic pressure
16 supplied by the regulator. As the lever **67** or switch is pushed or displaced, the pneumatic or air
17 pressure supplied from the output port **66** increases relative to the aforesaid displacement. In the
18 preferred embodiment, the output port **66** of the air pressure regulator **64** pneumatically feeds a
19 pneumatic input port **42** of the feed cylinder **40** thereby creating a linear force onto said shaft **44**
20 relative to the displacement of said lever **67**. When the air pressure regulator **64** is released, the
21 pressurized output port **66** is vented to atmosphere, thereby venting the feed cylinder **40** and allowing
22 the motor frame **12** to retract via the action of said springs **34**. In the preferred embodiment, the
23 pressure regulator **64** is an MAR-1CP manufactured by Clippard. Alternative embodiments may
24 utilize other brands or models of pressure regulators for cylinder movement.

25 Preferably, the air pressure regulator **64** is mounted with or near said motor frame **12** whereby
26 the hand of the user stays near and follows the drill motor actuation switch **20** and pressure regulator
27 **64** as the drill bit approaches the work material. A unique feature claimed in an embodiment of the
28 present invention and in furtherance of the foregoing is the ability of the user to utilize the index
29 finger to control the speed of the drill motor **18** via the actuation switch **20** and the thumb of the same

1 hand to displace the lever **67** of the regulator **64** to control the force on and movement of the drill bit.

2 The top plate **36** of said press frame **51** is mounted onto or near a first end **59** of a frame
3 support **58** or shaft which extends and mounts with a frame base **52**, thereby forming a gap between
4 said frame base **52** and the bit. The preferred embodiment utilizes a cylindrical shaft **58** on which the
5 frame base **52** may pivot or rotate. That is, the frame base **52** preferably has a through hole **60** of
6 substantially the same size as the frame support shaft **58**, thereby allowing the base **52** to pivotably
7 fit over the support shaft **58**. The frame base **52** preferably has one or more set screws **62** impinging
8 onto the support shaft **58** to slidably hold said base **52** onto and at a desired position with said
9 support shaft **58**. Alternative embodiments may utilize other methods or means of mechanically
10 fastening said frame base **52** onto said support shaft **58** without departing from the scope and spirit
11 of the present invention. These include but are not limited to welds, threads, screws and bolts,
12 frictional fits, and/or integral molding or casting.

13 In the preferred embodiment, said frame base **52** comprises a base plate **54** having the
14 aforesaid support shaft hole **60**. Alternative embodiments may utilize a frame base **52** having a
15 plurality of shapes or sizes. Unique to the base plate **54** of the present invention is the extension of
16 a base plate support **56**, preferably a bolt or screw, from the base plate opposite the side closest to
17 the drill bit. This feature is especially useful in conjunction with the suction cup **68** attachment
18 embodiment. When utilized apart from the suction cup **68** attachment embodiment, the base plate
19 **54** is typically rotated and secured under the drill bit. This allows the work material to be placed
20 between the drill bit and base plate **54** during the drilling operation.

21 One of the embodiments of the present invention utilizes a suction cup **68** mounted with a
22 second end **61** of said support shaft **58**. The suction cup **68** allows the drill press **10** to be mounted
23 onto and drill into a surface. This feature is especially useful when the work material cannot fit
24 between the drill bit and base plate **54**. This feature, unlike magnetic base drill presses, allows
25 attachment to a surface even if the surface has a low magnetic permeability such as aluminum, low
26 iron content metals, and non metals such as plastics and woods.

27 Said suction cup **68** is preferably evacuated and held in place via the vacuum of a venturi **74**
28 attached with said suction cup **68**. The suction cup **68** is commercially available from Schalmz
29 GmbH, yet is modified for the present art. Other commercial manufacturers such as Anver and others

1 provide equivalent suction cups which may be utilized with the present art. Within the cup cavity 70
2 is placed a mating plate 72 with a mating surface 73 which substantially conforms to the surface of
3 the work material. In the preferred embodiment, the plate 72 is attached within said cup cavity 70
4 yet the mating surface 73 is positioned such that it does not extend beyond the surface represented
5 by the large circumference of the suction cup 68. When the suction cup 68 is placed onto the work
6 surface and the venturi 74 evacuates or draws a suction on said cup 68, the mating surface 73 of the
7 mating plate 72 contacts the work surface thereby stabilizing the press frame 51. Alternative
8 embodiments may forego utilization of the mating plate 72. The base plate 54 with its base plate
9 support 56 is typically pivoted or rotated opposite or away from the location of drill bit contact with
10 the work material and secured to the frame support shaft 58. The base plate support 56 is extended
11 from the base plate 54 to contact the work surface and help stabilize the press frame 51 during the
12 drilling operation. That is, the base plate 54 serves as a moment arm to provide a counteracting force
13 relative to the drill bit force in order to maintain proper orientation of the press frame 51. Said base
14 plate support 56 is preferably a threaded bolt or screw but may also comprise any mechanical support
15 device which is capable of contacting the work surface and help stabilize the press frame 51.

16 In the preferred embodiment, a pneumatic switch 76 or valve is located on or near the motor
17 frame 12 or motor plate 14 and allows the user to easily supply compressed air to the venturi 74
18 which supplies vacuum to the suction cup 68. Since this switch 76 is located near the user's hand,
19 the user may easily turn on the pneumatic switch 76 prior to a drilling operation in order to secure
20 the device via venturi 74 vacuum to the work surface. When the switch 76 is positioned in an off
21 position, compressed air is no longer supplied to the venturi 74 and the venturi 74 allows the suction
22 cup 68 to vent to atmosphere. In the preferred embodiment the venturi 74 comprises a Fastvac
23 #VP00-60H manufactured by Vaccon but other manufacturers also commercially manufacture an
24 equivalent venturi. In the preferred embodiment, the venturi 74 is mounted upon the base plate but
25 may be mounted at any location which is desired, provided the suction cup 68 receives the required
26 vacuum.

27 An alternative embodiment of the present invention places the feed cylinder 40 at the base
28 plate 54 instead of the top plate 36. This alternative embodiment allows the feed cylinder 40 to apply
29 force to and move the work material toward the drill bit or drill motor 18 instead of the drill bit

1 moving toward the work material. This alternative embodiment preferably secures the drill motor **18**
2 to the top plate **36** of said press frame **51** which also functions as the motor frame **12**. Further
3 alternative embodiments may utilize both a feed cylinder **40** on the top plate **36** and a feed cylinder
4 **40** on the base plate **54**. In this configuration, typically the shaft **44** of the feed cylinder **40** mounted
5 on the base plate **54** contains a shaft tip **46** having a recess for drill bit clearance when the bit bores
6 through the work material. Alternative embodiments may forego use of the shaft tip **46** without
7 departing from the scope of the present art.

8 In operation, the user first connects an pneumatic compressed air supply to the power assisted
9 drill press **10** of the present art. If the user desires to drill a work material which will fit between the
10 base plate **54** of the frame base **52** and the drill bit, the user rotates and secures the base plate **54** in
11 a position substantially near or in the same axis as the drill bit. The user then places the work material
12 between said base plate **54** and the drill bit and activates or presses on the air pressure regulator **64**
13 activating switch or lever **67** to begin application of a user variable pressure to the feed cylinder **40**.
14 As the drill bit is moved near or onto the work material due to the movement of the feed cylinder **40**,
15 the user activates the drill motor **18** via a valve or switch **20** which energizes the drill and rotates the
16 drill bit. As the drill bit contacts the work material, the user may further press the air pressure
17 variable regulator **64** activating switch or lever **67** to supply a higher pressure to the feed cylinder **40**
18 and thereby increase the force on the drill bit. As the force on the drill bit increases, generally the
19 speed of cutting increases. After the user completes the drilling procedure, the user may release the
20 air pressure regulator **64** activating switch or lever **67** to vent the feed cylinder **40** to atmosphere,
21 thereby allowing retraction of the drill bit from the work material. The suction cup **68** may be utilized
22 to stabilize or secure the press onto a surface during the drilling process.

23 The alternative embodiment having the feed cylinder **40** located with the base plate **54**,
24 functions much as aforesaid. That is, the user places work material between the drill bit and the feed
25 cylinder **40** shaft tip **46** and performs the same aforesaid operation. Instead of the drill bit moving
26 relative to the press frame **51**, the press frame **51** moves relative to the work material via the action
27 of the feed cylinder **40**.

28 If the user should desire to drill a hole in a surface work material which cannot be placed
29 between the base plate **54** and the drill bit, the user then utilizes the aforesaid suction cup **68** to secure

1 the press frame **51**. That is, the user preferably first rotates the base plate **54** to a position
2 substantially opposite the drill bit in order to serve as a stabilizing moment arm relative to the drill
3 bit force. The base plate **54** is then secured via the set screw **62** impinging upon the frame support
4 shaft **58**. The user then turns on the valve **76** which supplies compressed air to the venturi **74** which
5 then evacuates the suction cup **68** and draws the press frame **51** onto the surface with the mating
6 plate **72** within the cup cavity **70** contacting the surface of the work material. The user may then
7 adjust the base plate support **56** to contact the work material surface and allow the base plate **54** to
8 provide the necessary counteracting moment arm relative to the drill bit. The user then repeats the
9 aforesaid steps of activating the regulator **64** via the lever **67** and drill motor **18** via the actuation
10 switch **20** to move the drill bit into contact with the work surface and drill the desired hole.
11 Alternative embodiments may perform the aforesaid functions without utilization of the mating plate
12 **72** or base plate **54**.

13 From the foregoing description, those skilled in the art will appreciate that all objects of the
14 present invention are realized. A power assisted drill press apparatus for drilling in non-
15 conventional applications where a drill press is desired or required is shown and described. The drill
16 press of the present art is especially suited to applications where portability is desired and with its
17 suction cup mounting is especially useful for mounting upon surfaces which are non-magnetic.

18 Having described the invention in detail, those skilled in the art will appreciate that
19 modifications may be made to the invention without departing from its spirit. Therefore, it is not
20 intended that the scope of the invention be limited to the specific embodiments illustrated and
21 described. Rather it is intended that the scope of this invention be determined by the appended claims
22 and their equivalents.

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